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Commentary: A surgeon's view of an engineer's data

Andrea J. Carpenter, MD, PhD

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CENTRAL MESSAGE

Engineering studies may offer insight into optimal valve design.

All surgeons have experienced early bioprosthetic valve failure, in mostly anecdotal numbers, defining our personal opinions about the reliability and durability of specific bioprosthetic valves. In this issue of the *Journal*, Lee and colleagues[1] offer the perspective of an engineer on several factors that may impact bioprosthetic valve durability. This report is timely, given the significant increase in use of bioprosthetic valves driven by the desire to avoid anticoagulation and the appeal of transcatheter aortic valve replacement as an option at the time of valve failure.[2]

The last several decades have brought a rapidly expanding variety and complexity of bioprosthetic valves.[3] We have stented valves with intact porcine valve tissue or constructed pericardial tissue. Stented valves include leaflets within the stent or leaflets wrapped around the stent, and stents are constructed of various materials and designs. There are stentless valves from human, porcine, and equine tissues. In response to the evolution of transcatheter valves, industry is turning out "sutureless" valves supported by a limited number of sutures, intended to reduce cross-clamp and pump times. Transcatheter valves are being developed at a rapid pace and approved with a variety of support structure and attachment systems that have in common some method of crimping the valve to fit through smaller vessels en route to the implant. All have in common the problem of durability. Data available on individual valves are often difficult for surgeons to consider as the definition of structural valve degeneration and the methods of defining the same are inconsistent.[4] Ultimately, it takes years of postimplantation review to evaluate the durability and modes of failure for these valves.

Lee and colleagues' report here is very interesting, but it offers little to help surgeons select valves currently on the market. Its real value is in the concept of assessing the structural design of manufactured bioprosthetic heart valves and how these designs impact function and durability. The methodology for evaluating structural behavior in vitro offers an appealing possibility for evaluating valve construct before clinical trials. We can only hope that studies like this will continue to expand, and that the information provided be available to and considered by the designers of bioprosthetic heart valves. Although building a creative valve to appeal to a broader market is an understandable objective of our industry partners, building a valve with better hemodynamic performance and longer durability is the real goal that we all seek.

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From the Department of Cardiothoracic Surgery, Joe and Teresa Lozano Long School of Medicine, University of Texas Health San Antonio, San Antonio, Tex.

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Address for reprints: Andrea J. Carpenter, MD, PhD, Department of Cardiothoracic Surgery, Joe and Teresa Lozano Long School of Medicine, University of Texas Health San Antonio, 7703 Floyd Curl, MC 7841, San Antonio, TX 78229 (E-mail: carpentera2@uthscsa.edu).

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